

REMARKS

Favorable consideration of this application is respectfully requested in view of the following remarks.

Claims 1, 6, 16 and 17 have been amended and Claims 2, 3, 5, 9-13 and 21 canceled. Accordingly, Claims 1, 4, 6-8 and 14-20 remain pending for consideration.

Claim 5 stands rejected as unpatentable under 35 U.S.C. § 103(a) in view of Shin, Gohl and Brown. The features recited in Claim 5 have been incorporated into Claim 1 and Claim 5 canceled. Hence, Applicants will refer to Claim 1 when addressing the rejection of Claim 5.

Claim 1 is directed to a heat-dissipation device having a combination of features, including a heat conducting terminal connected to a protective case and inserted into an insertion hole formed in the circuit board, a first heat conductive layer formed on an inner wall of the insertion hole, and at least one second heat conductive layer connected to the first heat conductive layer. The at least one second heat conductive layer includes a top heat conductive layer, at least one intermediate heat conductive layer, and a bottom heat conductive layer that are disposed on a top surface, an intermediate region, and a bottom surface of the circuit board, respectively.

The Official Action found that Claim 1 is not patentable because, *inter alia*, it would have been obvious to one of ordinary skill to use multiple heat conducting layers in view of Brown. In support for this view, the Official Action points to Brown's disclosure of a top heat conducting layer 112, intermediate layer 132 and bottom layer 134 illustrated in Fig. 10 of Brown. As explained below and in Applicants' response to the November 4, 2005 Official Action, there is nothing in Brown or elsewhere in the prior art that would have motivated one of ordinary skill to modify

Shin's device such that top, intermediate and bottom heat conductive layers are connected to a first heat conductive layer formed on an inner wall of a hole, and wherein such hole receives a heat conducting terminal that is connected to a protective case.

Brown discloses a PC board package that includes a plurality of PC boards bonded together to form a composite. A primary object of Brown's disclosure is to provide such a composite with an arrangement of heat tubes 36, 180, see e.g., col. 3, lines 8-15; col. 2, lines 54-58; and col. 8, lines 36-39. In the embodiments of Figs. 1 and 10 referred to in the Official Action, the composite PC board is designed to radiate heat from top and bottom layers adjacent to the heat tubes. Additionally, Brown mentions at column 8, lines 14-15 and column 4, line 45-47 that a heat sink can be attached to the layer 34 shown in Fig. 1 or to the pad 116, 136 shown in Fig. 10.

The Official Action seems to suggest that because Brown discloses metallic layers connected to metallic pins 44 which provide electrical communication with wire traces on the board, and because those layers possess heat conductive properties (because they are metallic), it would have been obvious to modify Shin's board to include multiple metallic layers connected to a heat conductive terminal that is in turn connected to a protective case in order to thermally conduct heat from the metallic layers to the case in order to arrive at the invention recited in Claim 5.

Applicants respectfully disagree.

Assuming one of ordinary skill in the art would have been motivated to combine the disclosures in Brown and Shin, that the two references are combinable does not establish a *prima facie* case of obviousness in this instance. In the end, the references must teach one of ordinary skill in the art that the device described in

Shin should be modified based on the disclosure in Brown in a manner that would result in that which is claimed. In this regard, the cited references fail.

An inspection of Brown reveals that there is no teaching or suggestion that the electrically conducting layers 112, 132, 134 should be connected to a terminal which in turn is connected to a protective case for heat dissipation. A careful study of the disclosure in Brown reveals that Brown is focused on providing a PC board package in which a plurality of PC boards are bonded together to form a composite. To impart heat dissipating properties to the PC board package, Brown describes that the board package is provided with heat tubes 36, 180 adjacent an integrated circuit chip positioned in a cavity of the package to conduct heat to the opposite surface of the package. Thus, to the extent an ordinarily skilled artisan would have been motivated to apply the heat dissipating aspect of Brown's disclosure to the device described in Shin as suggested in lines 14-17 on page four of the Official Action, one might replace Shin's circuit board 30 with Brown's PC board package that includes the heat tubes. However, the resulting arrangement would not include at least one second heat conductive layer connected to a first heat conductive layer on the inner surface of a hole, wherein the at least one second heat conductive layer includes top, intermediate and bottom conductive layers, and wherein a heat conductive terminal that is connected to a protective case is inserted in the hole so that the heat conducted from the electronic component to the at least one second heat conductive layer is further conducted to the heat conductive terminal as recited in Claim 1. More specifically, Brown does not disclose that the layers 112, 132, 134 are connected to, or should be connected to, a heat conductive terminal that is connected to a protective case. Quite the contrary, Brown describes that the layers 112, 132, 134 are connected to pins 44 to provide electrical communication to the wire traces on

the laminates. Those pins 44 are not heat conductive terminals that are connected to a protective case as recited in Claim 1.

The Official Action observes that the spacer 42 described in Shin corresponds to the claimed heat conductive terminal. If an ordinarily skilled artisan was interested in replacing Shin's circuit board 30 with Brown's multiple circuit board package provided with multiple metallic layers 112, 132, 134, there is no teaching in Brown or Shin (or Gohl) that the metallic layers 112, 132, 134 in Brown's board package should be connected to the spacer 42. Rather, as explained above, Brown specifically describes that the layers 112, 132, 134 are connected to the electrical connection pins 44 for purposes of providing electrical communication to the wire traces on the laminates 110, 130, 170. Thus, if one was motivated to use Brown's multiple circuit board package in place of Shin's circuit board 30, one would connect the layers 112, 132, 134 with electrical connection pins 44 because that is what Brown describes. However, the pin 44 cannot correspond to the claimed heat conductive terminal because the pin 44 is not connected to a protector case as recited in Claim 1. Thus, while it may be true that Brown discloses a PC board package that includes several metal layers 112, 132, 134 interposed between the laminates 110, 130, 170 forming the board package, there is absolutely no disclosure that the metallic layers should be connected to a heat conductive terminal that is connected to a protector case so that heat conducted from the electronic component to the metallic layers is further conducted to such heat conductive terminal.

The Official Action notes the comment at the bottom of column 4 of Brown pointing out that contact can be made between the metal coating 20 and selected traces comprising portions of the layer 12 to provide electrical contact as well as a

heat path from the back side of the die. This observation that contact between two metallic portions (i.e., the metal coating and the copper traces) provides a heat path is not disputed -- Brown merely states what is apparent, namely that metal can form a heat path. However, Brown's statement that contact between the metal coating 20 and some of the traces of the copper layer 12 provides a heat path from the back side of the die is not a teaching that would have directed one of ordinary skill in the art to connect the metallic layers to a heat conductive terminal that has one end portion connected to a protector case as recited in Claim 1 so that heat conducted from the electronic component to the metallic layers is further conducted to such heat conductive terminal.

For at least the reasons set forth above, Applicants respectfully submit that the claimed invention recited in Claim 1 is patentably distinguishable over a combination of the disclosures in Shin, Gohl and Brown. Withdrawal of the rejection of Claim 1 and allowance of this claim are earnestly solicited.

Claim 8 stands rejected over the combination of Shin, Brown and Roessler. The device recited in Claim 8 includes, *inter alia*, the heat conductive terminal having one end portion connected to the protective case and the other end portion inserted into an insertion hole, with a first heat conductive layer formed on the inner wall of the insertion hole. In addition, Claim 8 recites second conductive layers comprising a top heat conductive layer, at least one intermediate heat conductive layer, and a bottom heat conductive layer disposed on the top surface, an intermediate region, and the bottom surface of the circuit board, respectively, with the second heat conductive layers being connected to the first heat conductive layer so that the heat conducted from the electronic component to the second heat conductive layers is further conducted to the heat conductive terminal.

Claim 8 is patentable over the cited references for essentially the same reasons discussed above in connection with Claim 1. Applicants therefore respectfully request that the rejection of Claim 8 be withdrawn and this claim allowed.

Claim 16 stands rejected as unpatentable under Section 103 over Shin in view of Gohl and Garrett.

The combination of features recited in Claim 16 includes a heat conductive terminal having a second end portion inserted into an insertion hole formed in the circuit board, with the second end portion including a first protrusion contacting a top surface of the circuit board and a second protrusion contacting a bottom surface of the circuit board, wherein the heat conductive terminal is fixed in position relative to the insertion hole via the first and second protrusions, and wherein the first and second protrusions respectively contact the top heat conductive layer and the bottom heat conductive layer and are formed by cutting and bending parts of the heat conductive terminal.

The Official Action relies on Garrett's disclosure of a free end 24 of a forward lock tab 26 and crimping tabs 30 as corresponding to the first and second protrusions as set forth in Claim 16. Applicants respectfully traverse the rejection for the following reasons:

First, Garrett does not disclose a heat conducting terminal. Rather, Garrett discloses a terminal 10 for cut leads in a printed circuit board. In other words, the terminal 10 is an electrical conductive terminal, not a heat conductive terminal. Thus, one of ordinary skill in the art would not have found the disclosure in Garrett to provide relevant teachings regarding heat dissipation for use in the device disclosed in Shin.

In addition, there is no disclosure in Garrett that the ends 24 and 30 are placed in contact with the upper and lower surfaces, respectively, of the core section 20 as so to establish a thermal connection with an upper and lower heat conducting layer on the circuit board. This finding is supported by the fact that Garrett uses a solder joint 75 to establish an electrical connection of the terminal 10 to the core section 20. See col. 4, lines 16-30. Further, it is not even apparent from Fig. 2 that the second projection of the tab 26 contacts the lower flange portion of the core section 20.

For at least these reasons, Applicants respectfully submit that Claim 16 is patentably distinguishable over a combination of the disclosures in Shin, Gohl and Garrett.

Claims 4, 6, 7, 14, 15 and 17 to 20 recite additional distinguishing aspects of the claimed subject matter. As these claims are allowable at least by virtue of their dependence from allowable independent claims, a discussion of the additional distinguishing aspects is not set forth at this time.

It is believed that this application is in condition for allowance and such action is earnestly solicited.

Should any questions arise in connection with this application or should the Examiner believe that a telephone conference with the undersigned would be helpful

in resolving any remaining issues pertaining to this application the undersigned respectfully requests that he be contacted at the number indicated below.

Respectfully submitted,

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